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science (for managers) and by learning about practice (for researchers).

Corlett refers to, and seems to assume, 'increasing abandonment of marginal land', but caution is needed – the global human population is expected to increase by at least 50% to 2100 [12]; climate change will probably raise sea levels; and food and energy production will strain ecosystems. Urbanization and rural depopulation do not preclude biomass harvesting on rural land to supplement oil and other resources. More PAs are important, but so is management research and support for the many already existing PAs and their staff.

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Letter

Guidance Needed on Setting Dynamic Conservation Targets: A Response to Hiers *et al.*

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In the past decade, ambitious global targets have been set for conserving and restoring ecosystems [1,2]. Likewise, many countries have legislation that aims to minimize and reverse environmental degradation; these laws are premised on the condition of setting end points to evaluate whether such efforts have been successful. We agree with Hiers *et al*. [3] that overly prescriptive end points for restoration and conservation efforts do not reflect the dynamic nature of ecosystems and the uncertainty brought by global changes, and thus may result in ineffective use of resources. We advocate that scientists should now move to the next stage and offer solutions that reflect the challenges that land managers and policy makers face. Investing resources in conserving and restoring ecosystems and populations without clear goals to guide interventions may waste resources and frustrate legitimate interests to compensate for environmental damages.

Hiers *et al.* [3] highlight a number of illustrative case studies where overly prescriptive management targets did not reflect the full variance of reference conditions. They also point out that global change has resulted in novel assemblages of species, confounding the issue of defining a reference ecosystem. These important points reinforce earlier discussions in the novel ecosystems [4,5] and shifting baselines literature [6]. Hiers *et al.* [7] make broad suggestions for how policy makers and land managers should set targets that recognize inherent ecosystem variability, while avoiding an 'anything goes' approach and providing sufficient specificity to allow evaluation of success. As one specific option, they suggest using dynamic restoration targets. We agree that this is a promising approach to incorporate and spatial variability in reference systems, but question whether the specific analytical approach cited [7] falls within the expertise of most professionals in charge of assessing restoration and conservation success.

Land managers are faced with the challenge of moving from general national legislative requirements (e.g., the Endangered Species Act in the United States and the Forest Code in Brazil) to setting project-specific, localized goals and measurable objectives. Many are eager for strategies to make their conservation and restoration projects more effective, but depend on scientists to provide clear guidance on practical approaches to evaluate success. We contend that there is an urgent need for scientists to collaborate with restoration practitioners to develop concrete and practical ways to operationalize the inclusion of uncertainty and dynamism in conservation practice and policy. Pointing out the problem of uncertainties without offering practical alternatives leads to confusion amongst policy makers and practitioners and runs the risk of setting an extremely low bar for conservation efforts.

Drawing on the extensive literature on adaptive management to work with land managers to set, monitor, and re-evaluate targets that are consistent with project goals and realistic given local conditions can be a constructive learning process [8]. In Brazil, the current Forest Code mandates restoration of over 20 million hectares on private lands in the next 20 years, and governments must now define restoration targets for each ecosystem type to enforce the law [9,10]. In São Paulo state, minimum restoration

requirements were set in collaboration with scientists and a multistakeholder coalition [11]. Land managers are required to monitor their projects after 3, 5, 10, 15, and 20 years and share results on the environmental secretariat website, to determine whether ecosystems are on a trajectory toward targets and learn from the experiences of others. The overarching goal of this legislation is not to pre-establish fixed end points, which may take over 100 years to reach, but to safeguard that a minimum level of development is achieved to sustain ongoing ecosystem recovery, while recognizing the range in potential restoration trajectories.

A similar approach has been used in restoration programs of grassland and coastal scrub ecosystems in California (http://lrdp.ucsc.edu/cmitigation-monitoring.shtml), namely, (i) define a realistic range of local reference conditions through expert consultation and field surveys; (ii) frequent monitoring to incorporate interannual variability and determine when and what type of corrective actions are needed to maintain progress toward targets; and (iii) periodic consultation among land managers, a scientific advisory committee, and representatives of the California Coastal Commission to ensure that minimum requirements are being achieved and agree upon future restoration practices. Since the outcomes of restoration and conservation projects are strongly affected by interventions in the initial stages and uncertainty increases with time, we recommend a shift from end points to recovery trajectories, recognizing intermediate goals and adopting an adaptive management approach.

Now that the mismatch between dynamic ecosystems and static laws is well recognized, we urge scientists to work collaboratively with social scientists and policy makers toward potential solutions and test them in collaboration with land managers in a range of settings. We certainly do not have all the answers, but assert that investing scientific energies into developing practical solutions is critical to ensuring the best possible outcomes of conservation and restoration actions.

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